

# Deep Learning and parametric representations

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Visite du comité HCERES

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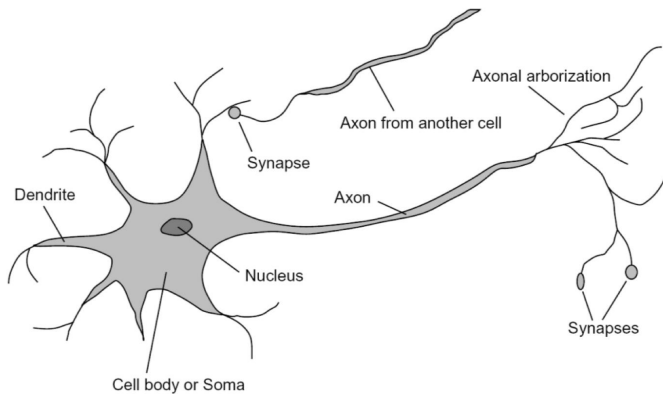
# Overview

**Introduction to Deep Learning / Neural Networks**

**Learning parametric representations of 3D shapes**

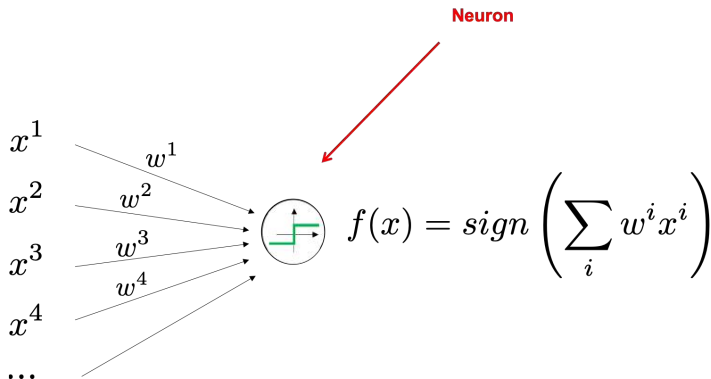
**Learning parametric representations of images**

# Deep Learning: Neuron

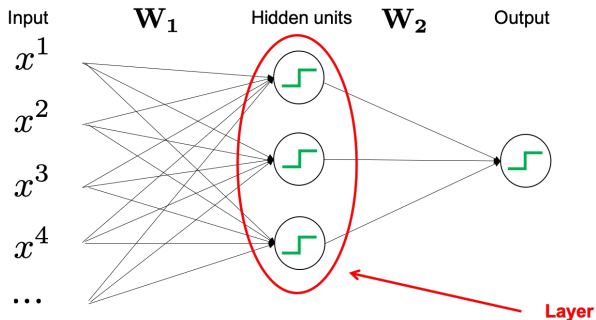


# Deep Learning: Perceptron

Frank Rosenblatt, 1957

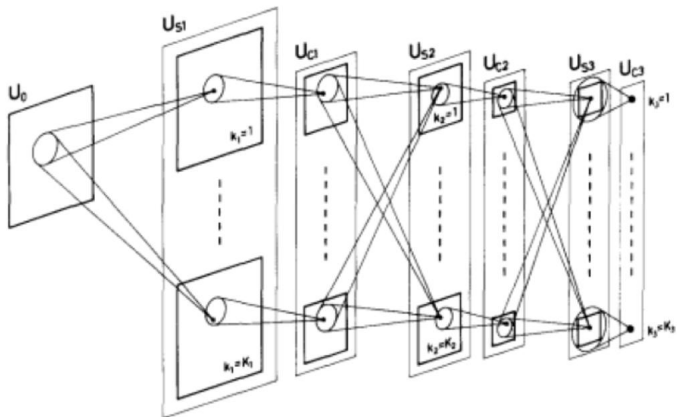


# Deep Learning: Multi-layer Perceptron (MLP)

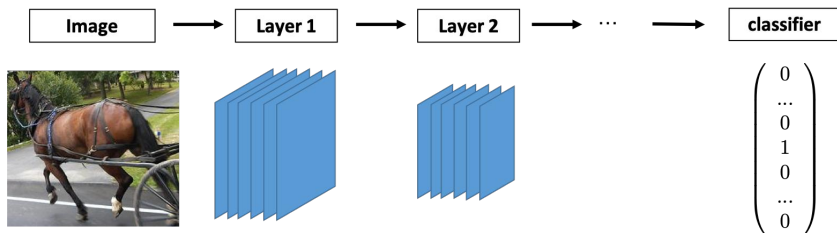


# Deep Learning: Neocognitron

Fukushima 1980 (Inspired from Hubel and Wiesel model of the visual cortex 1962)



# Deep Learning: Modern image classification



# Deep Learning: Summary

- ▷ Based on the succession of simple parametric operations
- ▷ Great success in image analysis
- ▷ Requires lots of **training data**
  - ▷ research axis on using **synthetic data** (see poster)
- ▷ For images, rely on **convolutional** architectures
  - ▷ research axis on **new architectures** (this presentation)



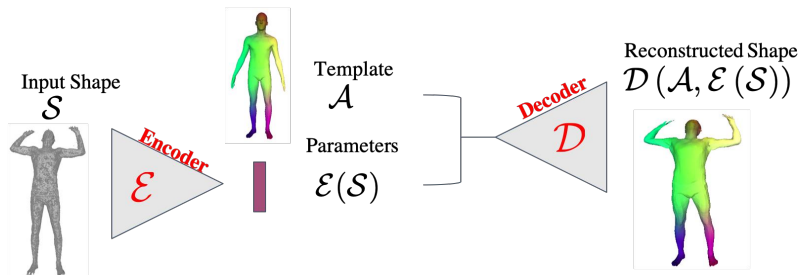
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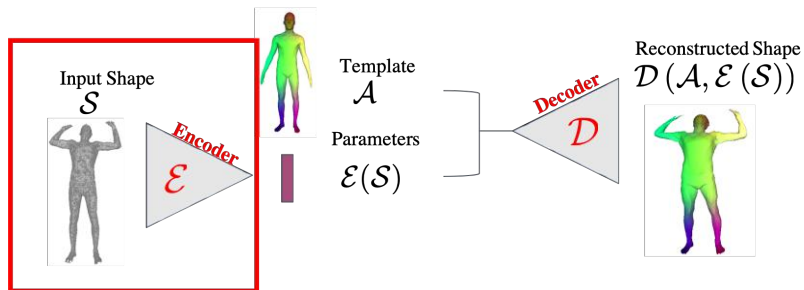
**Learning parametric representations of 3D shapes**

**Learning parametric representations of images**

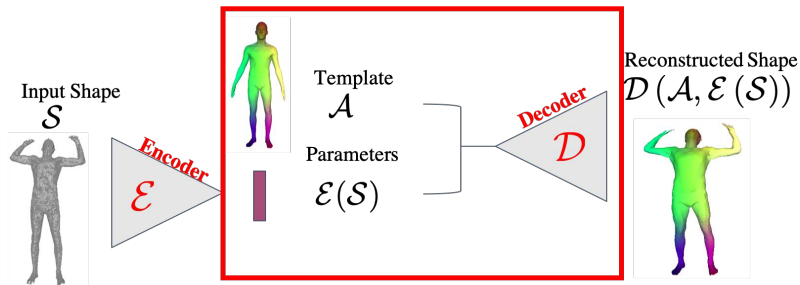
# 3D shapes: 3D-CODED, overview



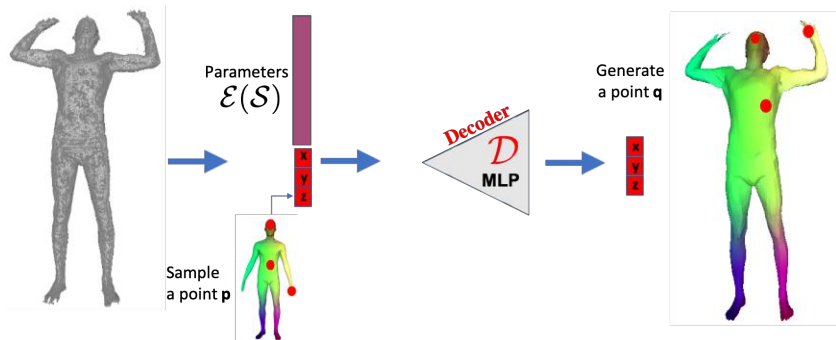
# 3D shapes: 3D-CODED, overview



# 3D shapes: 3D-CODED, overview

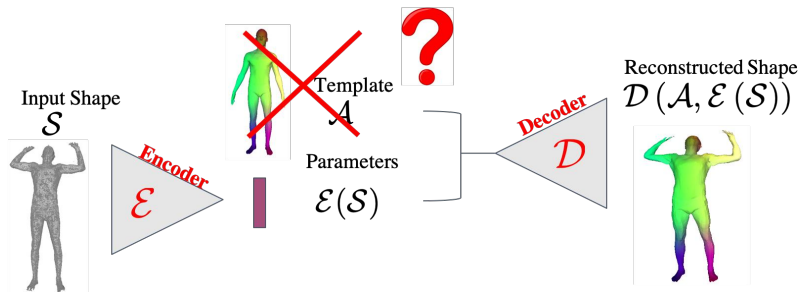


# 3D shapes: 3D-CODED, template-based representation

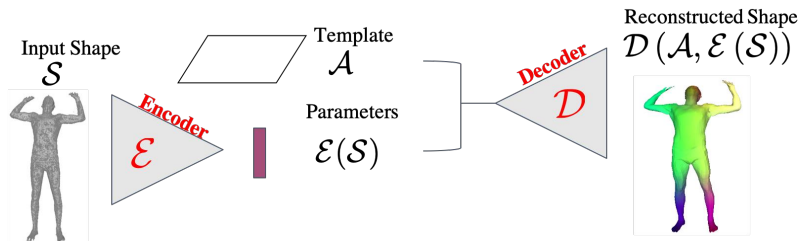


Groueix et al. 3D-CODED, ECCV 2018

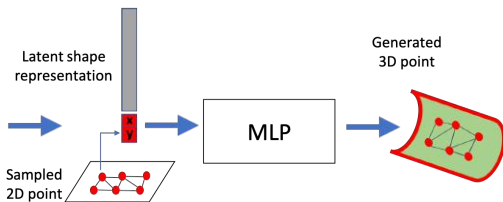
# 3D shapes: overview



# 3D shapes: overview

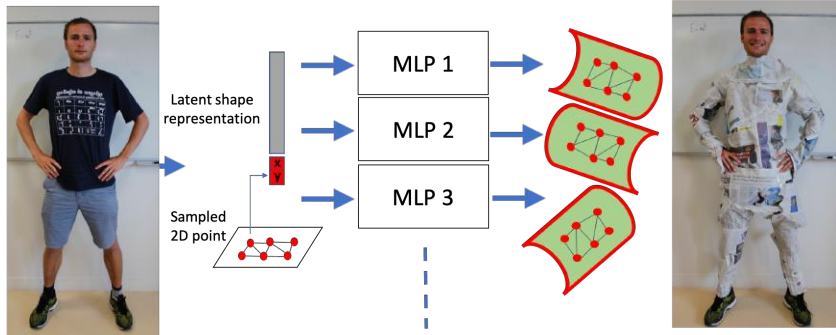


# 3D shapes: overview

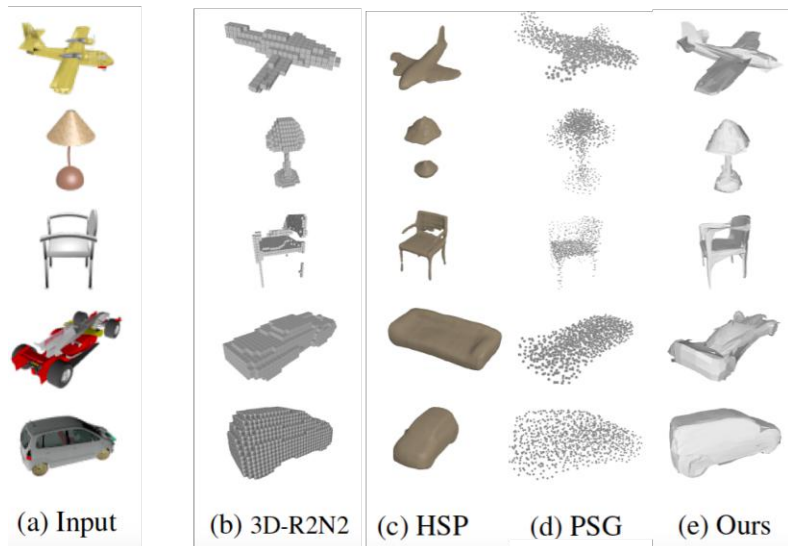




# 3D shapes: overview



# 3D shapes: overview



# Parametric representation for 3D shapes: Summary

- ▷ State of the art single-view 3D surfaces reconstruction with AtlasNet (CVPR 2018)
- ▷ State of the art correspondences between shapes with 3D-CODED (ECCV 2018)
- ▷ Important impact (citations, code usage, many papers on learning parametric volumetric representations submitted to CVPR 2019)

# Overview

**Introduction to Deep Learning / Neural Networks**

**Learning parametric representations of 3D shapes**

**Learning parametric representations of images**

# Parametric image generation: applications

Original



Mask



Edited

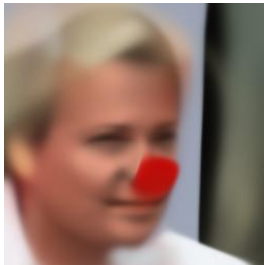


# Parametric image generation: applications

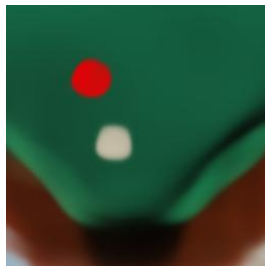
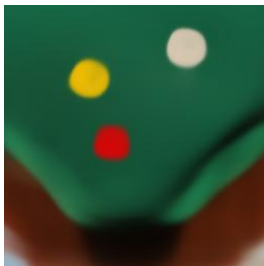
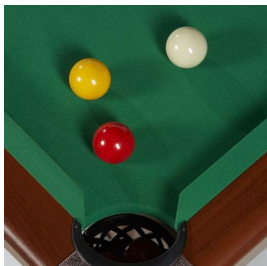
Original



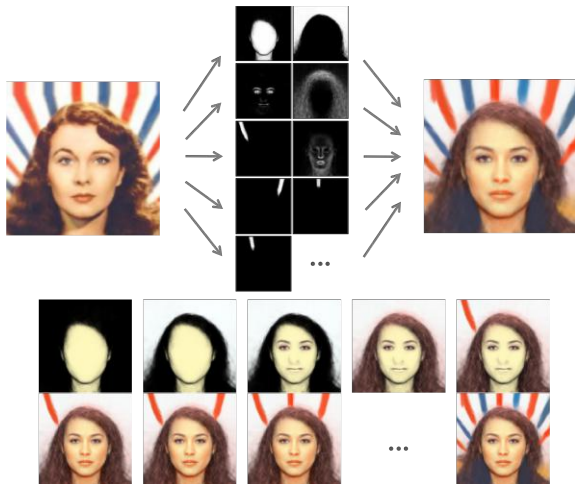
Rec.



Edited

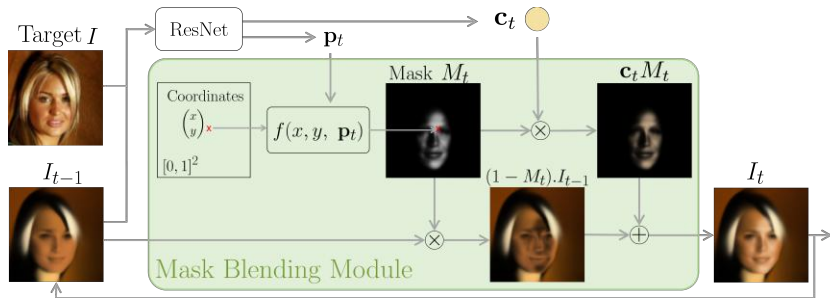


# Parametric image generation: idea



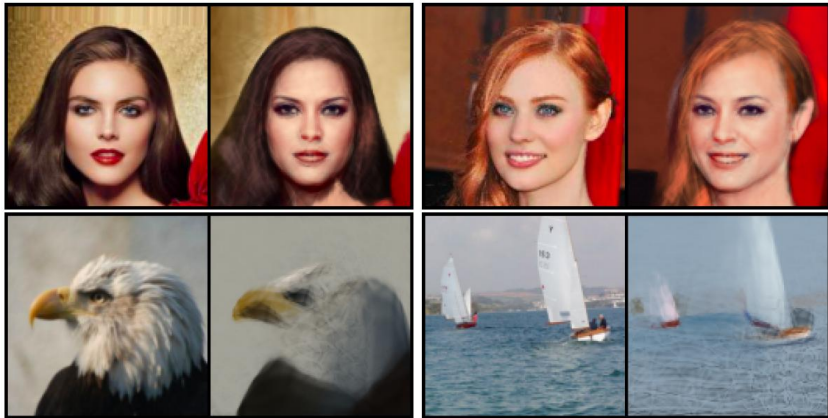
Sbai et al., ArXiv 2018

# Parametric image generation: overview





# Parametric image generation: results



# Parametric image generation: Summary

- ▷ Completely different from mainstream image generation approaches (based on convolutions/pixels)
- ▷ Generated images at infinite resolution
- ▷ Designed to allow new application (e.g. in design)

# Conclusion

Our deep learning research:

- ▷ Focus on innovation and long term challenges, rather than fighting with mainstream approaches.
- ▷ In the continuity with the historical lab expertise on 3D.
- ▷ Top conferences/journal publications, collaboration with companies (Adobe, Facebook...), high impact/visibility.